The Techno-aesthetical Architectural Dilemma: Paradigmatic Histories of Reinforced Concrete

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Introduction

The debate on the double dialectic Architecture-Aesthetics / Architecture-Ethics[1] is old but it takes on urgency in the context of the existential stakes of the Anthropocene.[2] This age is marked by the increasingly radical transformation of the contemporary world, which conforms to the evolution of a techno-natural environment whose new challenges lead us to question the complexity of our very connection to the world. These tensions have led to the creation of a chiasmus between the operative and the sensitive in architecture. While the operative dimension faces the urgent challenge of handling architecture's impact on nature and the environment, the sensitive one seems to turn into a matter of secondary importance at best and is almost ethically incriminated. This often leads to an abstraction of the importance of aesthetics in the architectural creation process, which is then reduced to its capacity of providing an answer to ethical problems.

> On the one side science, order, progress, internationalism, aeroplanes, steel, concrete, hygiene: on the other side, war, nationalism, religion, monarchy, peasants, Greek professors, poets, horses.
>
> George Orwell, *Wells, Hitler and the World State* (1941)

It is hardly surprising that concrete is at the core of these debates. Not only is it the most consumed substance on the planet after water, with a production rate of five billion cubic meters per year,[3] which raises concerns about its material footprint, but it is also, *as a human technique*, the epitome of the domineering attitude that we've had towards nature over the last two centuries. The socio-political upheavals experienced by the Western world during the 18th and 19th centuries have led to the rise of a progressive tendency that fostered the rapid development of technology and the search for a new identity that was marked by the advent of modernity. This context allowed the gradual and collective invention of reinforced concrete,[4]

1 For different views on the question of ethics and aesthetics in architecture, see: Maurice Lagueux, "Ethics versus Aesthetics in Architecture," *The Philosophical Forum* 35, 2 (2004): 117-133, and Raluca Becheru, "The Morailty of Bricks," *sITA – studies in History and Theory of Architecture* 7 (2019): 27-38.

2 The current geological age places humans as the primary geological force. This concept goes beyond the geo-historical reality to take on philosophical, religious, anthropological, and even political dimensions. This complexity and the various kinds of tensions that it creates, require a re-evaluation of the concepts that govern our perception of the world. See: Bruno Latour, "L'Anthropocène et la destruction de l'image du Globe" ["The Anthropocene and Destruction of the Image of the Globe"], in *De l'univers clos au monde infini [From the Closed Universe to the Infinite World*], ed. Emilie Hache (Paris: Éditions Dehors, 2014), 27-54.

3 Statistic estimation of https://www.worldcement.com/

4 This invention was the result of multiple systems and processes and is therefore difficult to pinpoint. Still, some names are worth mentioning, including those of Joseph Lambot (patented in 1849), William Boutland

which participated, through the special efforts of engineers and entrepreneurs, in the disruption of the traditional aesthetic canons. It paved the way to a new plural aesthetic that rid the architectural practice of its formal and historicist apriorities and that was governed by the transformation of architecture's relationship to technology and society. In his film *Opération béton*[5] Jean-Luc Godard uses an almost Olympian discourse to describe the construction of the Grande-Dixence Dam: thanks to technology and reinforced concrete, mankind defies nature, the climate, and the invincible. A similar propagandist discourse accompanied the architectural history of concrete and transformed it into a utopian paste, that in the union-produced film *Les bâtisseurs*[6] directed by Jean Epstein in 1938, reunited the proletarians and enabled the *heroization* of the anonymous builder, the symbol of social revolution. As an innovative, rational, social, and universal material, reinforced concrete became, for better and for worse, the emblematic material of modernity. This gave it a new status as a material-medium that

> "… tells us what it means to be modern. It is not just that the lives of people in the twentieth century were transformed by, amongst other things, concrete – as they undeniably were – but that how they saw those changes was, in part, the outcome of the way they were represented in concrete. Like the internal combustion engine, antibiotics, genetically modified crops and digital technology, concrete realized the prospect of transforming nature, and of transforming ourselves and our relationships with each other."[7]

This transformation changed the perception of the *Good* and *Beautiful* in Architecture that would then – from a moralistic and often-utopian perspective – be in charge of the happiness of humanity. We can see here how, in many respects, reinforced concrete architecture was marked early on by a moral connotation that – magnified by repercussions of the ideological failures of modernism – contributes nowadays to its incrimination by a large part of the ethical[8] and ecological discourses.[9] The place that concrete could occupy in 21st century architecture is further complicated by its elusive aesthetics.[10] This is because

> "Concrete has offered itself to all the doctrines, all the currents, all the whims that have nourished the architectural debate in half a century. Is it a sign of docility, of spinelessness, or a sign of suppleness, of flexibility?"[11]

At a time when the very notion of architectural aesthetics is in crisis, it may seem delusional to continue talking about a material as contradictory and problematic as reinforced concrete. However, in the absence of a better substitute, concrete's universal – physical

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Wilkinson (patented in 1854), Joseph Monier (patented in 1867), Anatole de Baudot (several applications of the Cottancin system), etc.

5 *Opération Béton* [*Operation Concrete*]. Directed by Jean-Luc Godard (Geneva: Actua Films),1954.

6 *Les bâtisseurs* [*The Builders*]. Directed by Jean Epstein, 1938. Produced at the demand of the construction industry union (Fédération nationale des travailleurs du bâtiment, des travaux publics et des matériaux de construction).

7 Adrian Forty, *Concrete and Culture: A Material History* (London: Reaktion Books, 2012), 14.

8 Because of the ethical approach, which was for a long time oriented towards questions of form and style, the evaluation of reinforced concrete architecture was often done through doctrinaire optics. This has contributed largely to the problematic place it occupies nowadays. See: G. Martin Moeller Jr, "Reinforced Concrete and the Morality of Form," in *Liquid Stone: New Architecture in Concrete*, ed. Jean-Louis Cohen and G. Martin Moeller Jr. (New York: Princeton Architectural Press, 2006), 156-158.

9 Adrian Forty dedicated a full chapter to the concrete sustainability dilemma in which he discusses the multiple inconsistencies in the debate around the ecological impact of concrete. See: Forty, *Concrete and Culture*, 69-77.

10 This aesthetic indeterminacy has accompanied reinforced concrete since its invention and had also been linked with a moral meaning. *Mongrel, dangerous, unnatural, revolutionary, liberating*, the material's incapacity of *finding a proper form* and of *fitting* naturally into the historicist narrative have also contributed to its problematic existence. See again: Martin Moeller Jr, "Reinforced Concrete and the Morality of Form," 156-158.

11 Cyrille Simonnet, *Le Béton, Histoire d'un Matériau. Économie, Technique, Architecture* [*Concrete, History of a Material. Economy, Technique, Architecture*] (Paris: Editions Parenthèses, 2009), 190. [Authors' translation].

and metaphysical – providentiality obliges us to do so. How, then, can reinforced concrete architectures be evaluated without technical or aesthetic alienation? To answer this question, we first propose referring to Simondon's ethics,[12] which, unlike the accusatory and alienating discourses, would invite us to understand and acknowledge this providentiality and to strive to reduce its *destructive* aspect.[13] As such, the answer seems to reside in the simondonian techno-aesthetics,[14] which seek to reconcile the physical and metaphysical qualities that this material-medium can confer. Through his reflections, Gilbert Simondon[15] urges us to go beyond the double reductionism of aesthetics to contemplation, and technique to function, and to focus instead on the constitutive relationship between the two, which combines the sensible with the operative. Technical objects – in our case, architectural reinforced concrete objects – maintain a mediating relationship[16] between nature and humans: they condense within them both nature (by integrating, obeying, defying it ...) and all human effort. According to Simondon, this relationship manifests itself either *phanero-technically* – by displaying the technicality of the object – or *crypto-technically* – by concealing it behind cultural interfaces. This techno-aesthetic conception leads us to a plural interpretation of architectural Beauty that goes beyond visual quality to include an aspect of *synthesis* and which, as identified by Illies and Ray,[17] can be formal, functional, contextual, time-related, and intellectual.

These are the principal considerations that shape our perception of reinforced concrete architecture of the second half of the 20th century in Algeria. The major projects designed during this period – by several prominent architects of different nationalities – were deeply influenced by the social, economic, and political context. This cosmopolitan context allows us to closely explore the endogenous complexity of this material-medium's architectural and expressive contradictions. Indeed, the preliminary evaluation of the different case studies discussed in this paper reveals the multiplicity of approaches and conceptual paradigms that generated them. This architectural saga seems to be governed by opposing considerations: utopian and pragmatic; universal and regional; progressive and atavistic. What role, we might ask, did reinforced concrete play in the construction of this saga? What are the implications of reinforced concrete's ubiquitous qualities on this production?

This research attempts to navigate these questions by elucidating the techno-aesthetic subtleties and corresponding paradigms of this architectural production and in doing so, it aims to rehabilitate a little-known part of the country's architectural and constructive history.

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12 This is because we want to distance ourselves from the *ethical fallacy* (Watkins, 1977) of judging architecture on moralistic grounds. See: Gilbert Simondon, "Trois perspectives pour une réflexion sur l'éthique et la technique (1983)" ["Three Perspectives for a Reflection on Ethics and Technique"], in *Sur la technique (1953-1983)* [*On Technique (1953-1983)*] (Paris: Presses Universitaires de France, 2014), 337-351.

13 As done by technical research that focuses on the optimization of this material. See: Franz-Josef Ulm, "What's the Matter with Concrete?" in *Liquid Stone: New Architecture in Concrete*, ed. Jean-Louis Cohen and G. Martin Moeller Jr. (New York: Princeton Architectural Press, 2006), 218-221.

14 It is important to note from the outset that techno-aesthetics is not a properly developed theory, but more of a way of thinking that should be placed within the general conceptual framework of Simondon's work. See: Ludovic Duhem, "Simondon et la techno-esthétique" ["Simondon and Techno-aesthetics"], https://www.implications-philosophiques.org/non-classe/simondon-et-la-techno-esthetique/

15 Simondon's work, despite its important perspectives, remained unexplored for a very long time. His status as one of the most important thinkers of the 20th century is slowly being confirmed, particularly in the field of the philosophy of technology. While he never truly analyzed architecture, it appears repeatedly in his work, especially through discussions of Le Corbusier and his reinforced concrete chapel of La Tourette.

16 Note that this reflects Simondon's anti-technophobic stance. It seems to us that a philosophy that would oppose us to technology couldn't be relevant in the context of the Anthropocene.

17 In their book, the writers offer a compelling survey of the Aesthetics vs. Ethics dilemma in architecture. See: Christian Illies and Nicholas Ray, *Philosophy of architecture* (Cambridge: Cambridge Architectural Press), 2014.

Algeria and Its Reinforced Concrete Saga

The period that interests us in this research starts after the country's independence (as of 1962) but we should first recall that the Algerian reinforced concrete chronicle begins during the period of French colonization. The country represented an important field of experimentation that allowed the flourishing of architectural and constructive expressions, which were encouraged by the mass production of cement and the *technological reproducibility*[18] of the post-World War reconstruction context.[19] All of which led to the implementation of a fructuous technical and cultural transfer process that was achieved in two manners. On the one hand, technological transfer: through construction firms, in particular the international firm F. Hennebique[20], whose technical studies office (B.E.T.) opened in Algiers in 1893, and the Perret firm (Auguste and brothers), which became involved in the Algerian architectural scene as early as 1889.[21] On the other hand, cultural transfer: through the activities of Auguste Perret[22] (both entrepreneur and architect) and Le Corbusier.[23] Their disciples enthusiastically appropriated the precepts of Modernity, all the while integrating a regional dimension in favor of an *Algerian Modernity*. Note that even if no project of the dozen he designed in the inter-war period was built, Le Corbusier's influence extended to the post-independence.[24]

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18 This concept presented by Walter Benjamin sheds light on how modern industrialization had transformed not only the process of creating and distributing art objects (i.e., architecture) but also their essence and reception. The traditional, ritualized and unique artistic objects are transformed into democratized and continuously renewed objects, which creates a dialectical relationship between the object and the masses. In the case of concrete architecture, this is seen through the manner post-war prefabrication systems allowed the spread of R-concrete technology, which took on a geopolitical identity by adopting different socially situated interpretations of what started as a serially reproduced *international style.* See: Walter Benjamin, "The Work of Art in the Age of Its Technical Reproducibility," in *Selected Writings Vol III 1933-8* (Cambridge MA: Belknap Press, 2002).

19 Even if the Algerian territory was not directly affected by the destructive aspect of the two World Wars, it was still impacted by their financial repercussions and benefited from the subsequent modernization process. This post-war context allowed the almost total generalization of reinforced concrete construction, which permitted the economy of labour and resources.

20 This firm presents an interesting example of the decentralized transfer of techniques through its concessionaire network, which allowed the rapid expansion of the firm and ensured a non-linear exchange between the different collaborators. See: Assia Samaï-Bouadjadja. "Hennebique Reinforced Concrete Constructions in Eastern Algeria: Patrons and Contractors, 1900-1930," in *Building beyond the Mediterranean: Studying the Archives of European Business (1860-1970)*, ed. Claudine Piaton, Ezio Godoli, and David Peyceré (Arles: Honoré Clair, 2012), 138-147.

21 The architect Albert Ballu first collaborated with the company for the realization of several of Algeria's international exhibition pavilions, including those of the Paris *Exposition Universelle* of 1889 and 1900, and then entrusted them with the completion of Oran's Sacred Heart Cathedral building (1912), the first of their major reinforced concrete projects in the country. See: Guy Lambert, "L'Algérie et l'entreprise Perret," in *Encyclopédie Perret*, ed. Jean-Louis Cohen, Joseph Abram, and Guy *Lambert* (Paris: Editions du Patrimoine, 1998), 55-59.

22 Beyond the collaborations and realizations of the company, Auguste Perret's imprint is clear through the influence of his structural neo-classicism on many architects in Algeria, including Jacques Guiauchain and Léon Claro. See: Saïd Almi, *Urbanisme et colonisation : présence française en Algérie* [*Urbanism and Colonization: French Presence in Algeria*] (Liège : Mardaga, 2002), 90-96.

23 See Alex Gerber, "Le Corbusier cherchant à faire d'Alger une capitale du XXème siècle" ["Le Corbusier Seeking to Make Algiers a Capital of the 20th Century"], in *Alger, lumières sur la ville* [*Algiers, Lights on the City*], ed. Naïma Chabbi- Chermouk et al. (Algiers: Ed. Dalimen, 2004), 153-167.

24 Many of the architects working in the Algerian territory after independence were part of the Corbusian circle or were influenced by him. To oppose the initial Aurassi Hotel project [discussed below], a group of French and Swiss architects and urban planners fruitlessly suggested replacing it with Le Corbusier's Plan Obus skyscraper and building it in "La Marine" neighborhood. They even organized a commemorative exhibition presenting this project after his death in 1965. It is also interesting to note that - through a logic of reverse cultural transfer - the Algerian territory and the diversity of its vernacular architecture, in turn, influenced Le Corbusier's late work. See: Ibid.,164.

In 1962, the recently independent country quickly faced the challenge of regaining its full sovereignty. The mass departure of the French colonists after 130 years of colonization has led to the crumbling of a good part of the productive institutions and the loss of qualified professionals, further complicating what had already been a long and delicate mission. The constructive history that we will discuss in this contribution has known three major periods.

The first period, from 1962 to 1965, was marked by a tumultuous political and organizational atmosphere, which was not conducive to the construction of major projects. The focus was on stabilizing state structures and establishing the basis for *autogestion*. The construction sector was dedicated to urgent projects and reconstruction. These operations were made possible through the collective effort of Abderrahmane Bouchama[25] and anti-colonial French-Algerian architects,[26] with the collaboration of some invited architects including Italians, Swiss, and Egyptians, etc.

The second period (1965-1978) began with Houari Boumediene's *coup d'état*. This new president maintained the socialist ideology and placed himself at the head of the country's multidimensional restructuration project. This project aimed first and foremost to decolonize the country and give it a new identity,[27] which could also be seen as an attempt to – if we were to paraphrase Walter Benjamin – *ethicize the politics* of the regime in place. The lack of structures and facilities capable of accommodating this *second revolution* was quickly noticed and, from the mid-1960s onwards, the government invested in the construction of major state, education and cultural facilities. Following the creation of the COMEDOR[28] in the late 1960s, a number of internationally renowned architects were invited. They would become the main protagonists of the architectural dimension of this new revolution, with the contribution of architects from the first period. In this context, reinforced concrete was chosen as the emblematic material of the renewed Algeria. The architectural expressions, as diversified as they were, were reflected through the different formal manifestations of this material (surface; structure; plasticity), and translated the diverse conceptual paradigms of these architects among whom Oscar Niemeyer, Kenzo Tange, Fernand Pouillon, Luigi Moretti, Georgette Cottin-Euziol, etc.

The third period under the rule of Chadli Bendjedid (1978-1992), saw a semi- conversion to political openness and free-market system that were imposed by the economic crisis of the time. The built projects were mainly located in the capital (Algiers) and destined for leisure and commercial use, thus reflecting a *monumentality of consumption.*[29]

In this succession of contexts and regimes, it is clear that the lack of professional expertise and industrial infrastructure has been a determining factor in the internationalization of the construction sector. This techno-economic situation, combined with the lack of skilled labor and the urgency of needs, partly explains the enthusiasm for reinforced concrete, which contributed to the blossoming of architectural and constructive experiments. In what follows, we will proceed with a first presentation of the dominant paradigms that have regulated these experiments. This classification is neither absolute nor definitive but is based on our preliminary understanding of this corpus of study.

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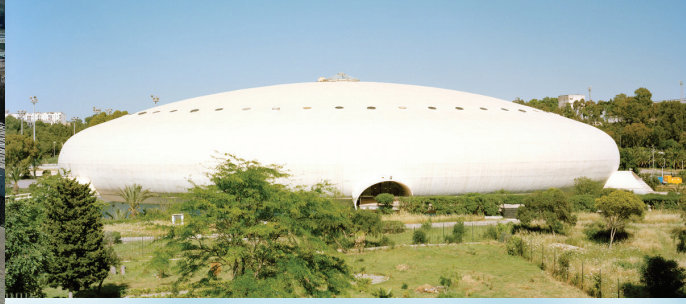
25 The only "native" architect in the country at the time of independence. He actively participated in the foundation of the Union of Algerian Architects and the reopening of the Beaux-Arts school of Algiers, with Léon Claro and Bachir Yelles as of 1963.

26 Born in Algeria of French origins, the majority of these architects called themselves Algerian and held an anti-colonialist stance.

27 According to Nadia Oulebsir, this identity is based on three values: The State, the Nation and Modernity. See: Nabila Oulebsir, *Les Usages Du Patrimoine: Monuments, Musées Et Politique Coloniale En Algérie, 1830-1930* [*The Uses Of Heritage: Monuments, Museums And Colonial Politics In Algeria, 1830-1930*] (Paris: Maison des sciences de l'homme, 2004), 308.

28 Permanent Committee for Studies, Development, Organisation and Planning of Algiers, created in 1968.

29 Concept introduced in: Youcef Kanoun and Salima Taleb- Kanoun, "Idéologie et identité: les projet de prestige après 1962" ["Ideology and Identity: Prestige Projects after 1962"], in *Alger: Paysage urbain et architectures: 1800-2000* [*Algiers: Urban Landscape and Architecture: 1800-2000*], ed. Jean-Louis Cohen, Youcef Kanoun, and Nabila Oulebsir (Besançon: Ed. de l'Imprimeur, 2003), 252-265.



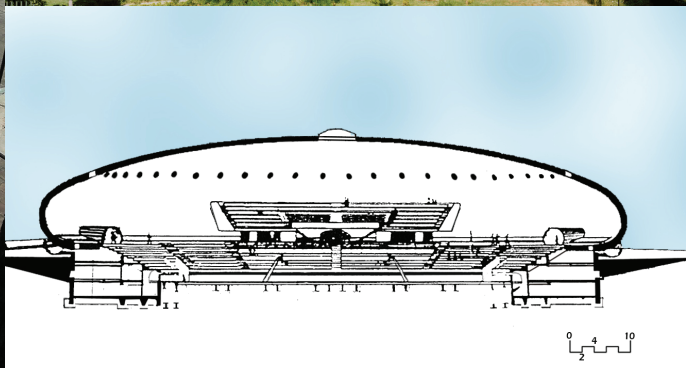


Fig.1 General view of the UMC campus from the administrative tower. 2018
Fig.2 Jason Oddy. La Coupole I, Algiers, Algeria, 2013
Fig.3 Cross section of La Coupole

Phanerotechnical Paradigm[30]

Most of the architecture of this period was imbued with the progressive ideology of the time, which sought to flaunt the new modern and universal identity of the country. This progressiveness was often expressed through particular tectonics: technical prowess, exposed concrete (in most cases), a sculptural or monumental treatment.

The Brazilian Oscar Niemeyer (1907-2012) – the first *star architect* to arrive in Algeria – designed a dozen projects for the country, of which only three will be built: the University of Constantine (UMC), the University of Science and Technology (USTHB) and the national school of architecture (EPAU)'s campuses. These projects had to convey the modernization project that Niemeyer and Boumediene both embraced.[31] To do so, they had to be technically and formally bold and devoid of regional or local considerations. The project of the University of Constantine (Fig.1), for example, is his most accomplished project in Algeria.[32] This project sought to demonstrate the superiority of the Latin American mastery of construction[33] by standing out from the architecture inherited from the French colonial period. This project

30 We borrow this concept from Simondon, who uses it to designate objects displaying their technicity. In his letter to Derrida, this is used to describe the architectures of Xénakis, Léger and Le Corbusier. However, we allow ourselves to extend the meaning of phanero-technics in architecture, to include any architectural object designed from a technical space of reference, i.e., seeking to exhibit its technicality, regardless of the manner. See: Gilbert Simondon, "Réflexions sur la techno-esthétique (1982)" ["Reflections on Techno-aesthetics"], in *Sur la technique (1953-1983)* [*On Technique (1953-1983)*] (Paris: Presses Universitaires de France, 2014), 379-395.

31 In his memoirs, Niemeyer revealed that H. Boumediene offered him all possible support. See: Edouard Bailby and Oscar Niemeyer. *Niemeyer par lui-même: l'architecte de Brasilia parle à Edouard Bailby* [*Niemeyer by Himself: Brasilia's Architect Talks to Edouard Bailby*] (Paris: Ed Balland, 1993), 130.

32 Niemeyer and his team did not monitor the construction of the other projects and often complained of the changes that the Algerian side introduced to the designs.

33 For example, the French experts that reviewed the design for the UMC had required the façade (which is actually a wall-girder) of the teaching block to be 150 cm thick but the Brazilian team managed to successfully make it 30cm thick (calculated by Bruno Contarini).

showcases the different tectonic and formal potentials of reinforced concrete through an assembly of daring horizontal, vertical and plastic forms: free spans of 50 meters, cantilevers of 25 meters, a tower of 22 levels, raw concrete and, as *pièce de résistance,* a hyperbolic auditorium that is characterized by the architect's emblematic curves and sensibility.

Despite the controversy around it,[34] Niemeyer's contribution is an interesting example of a successful model of both cultural and technological transfer. The arrival of the Brazilians to Algeria also contributed to the training of the Algerian team responsible for the design and construction of the project of the omnisports hall *La Coupole* (the dome) in the Olympic city (1972) (Fig. 2-3), which is falsely attributed to Oscar Niemeyer.[35] This reinforced concrete monocoque, with its diameter of 96 m, with no intermediate supports, is a demonstration of spectacular technical prowess.[36] Its complete design and technical studies were carried out by the team of young architects and engineers of the Algerian public economic enterprise *ECOTEC*[37] with, for certain specific problems, the collaboration of some Brazilian and Polish engineers, as well as the University of Rio de Janeiro.

Kenzō Tange's (1913-2005) projects, the University of Science and Technology of Oran's (USTO) campus (1971) and the 2000-bed student residence in Constantine (1975), introduce a rather different monumental aesthetic. The first is a typical demonstration of the architect's structuralist expression that flaunts a grid-based layout of heavy horizontal volumes; the second, implanted on the crest of a hill, is made of two upturned half-pyramidal buildings – very reminiscent of Le Corbusier's *Lotissement Durand* project (Algiers, 1933) – where the buildings' shape, mass and implantation are an apparent attempt at defying gravity. In these projects, Tange invites the Japanese aesthetics of concrete which, according to Adrian Forty,[38] favors the expression of mass and solidity, and whose redundancy sets it apart from *the asceticism of the Western model.*[39]

As for the Italian team, led by Luigi Moretti (1907-1973), they have opted for a less monumental aesthetic, but one that is oriented towards the morphology-typology dialectic. Their first mission was the completion of the Hotel El-Aurassi (1969), whose construction was interrupted by the Egyptian architect Mustapha Moussa's death. Moretti transformed the

34 His work in Algeria has known several shortcomings in relation to the functionality of the spaces designed (thermal quality, ventilation, etc.) and the ageing of their concrete. However, it is difficult to identify his responsibility for most of them since he distanced himself from their construction. Many Western critics accuse the architect of being a "capricious" artist that cares more about the shapes of the buildings than their functionality. See: Forty, *Concrete and Culture*, 125.

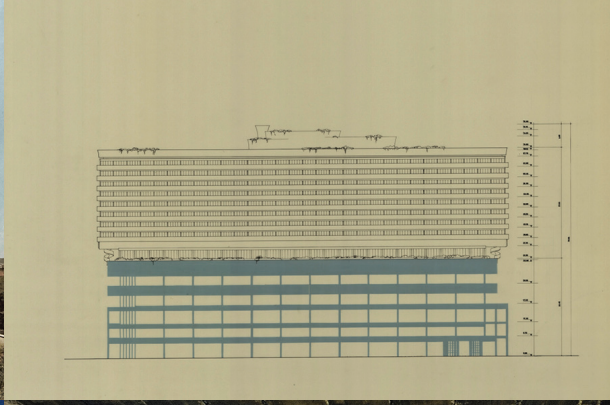
35 The project of the Olympic city is often presented as a project of Niemeyer, even in the local research. (See for example: Kanoun and Taleb- Kanoun, "Idéologie et identité," 252-265.) However, the various sources and archives of press articles presented by Ahmed Agguerabi (ex-Aggoun) on the website http://www.agguerabi.com reveal that the project was fully elaborated out by his team of engineers and architects. They would have only collaborated with Niemeyer during the preliminary studies (his intervention never went beyond a rough draft sketch).

36 World record for Lambardi's slenderness coefficient according to Agguerabi (PhD eng).

37 A public planning office set up by the Ministry of Finance and Planning to carry out economic studies, it eventually became a relatively large design and construction company.

38 Forty, *Concrete and Culture*, 135.

39 There have been many Western critiques of the different concrete aesthetics such as those of Japanese and Brazilian concrete architecture. For more on this see: Ibid., 120-141. As for this particular project, it had also been criticized in the following passage from Bernard Huet's *Anachroniques architecturales* [*Architectural Anachronisms*] (1981): "In Oran, it is a great pseudo-technological machine that acts as a 'symbolic monument', the same one that is dragged around in the dreams of architects who confuse grandeur with bulk, power with over-dimension, architecture with construction, and simulate technological expressionism, all the more desperately because true technique escapes all forms. Shouldn't we instead choose a 'monumentality' that is perhaps less outward, which does not refer so explicitly to the 'modernist' stereotypes of the West, but which slowly emerges from the depths of dialogue and the work of a 'foreign' architect in the face of the humblest as well as the most exhilarating Algerian economic and cultural realities." Quoted in: Ammara Bekkouche, "Images d'Oran" ["Images of Oran"], *Insaniyat* 23-24 (2004): 84-85 (authors' translation).



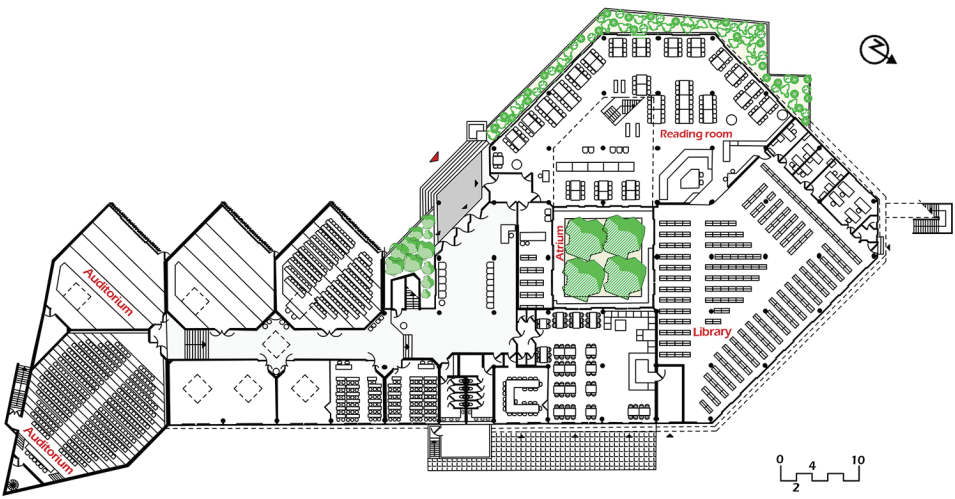


Fig.4 Elevation of the southeast façade of the Aurassi Hotel showing S. Zorzi's project for the structure's reinforcement, dated May 30, 1968

Fig.5 General northwest view of the Aurassi hôtel from the 1970s

Fig.6 Overview of the extension of Benaknoun's Law faculty

Fig.7 Interior view of the faculty's library

Fig.8 First floor plan of the extension of Benaknoun's Law faculty

Fig.9 Different views of Maqam E'chahid and the *Arts Centre* (opposite page)

project's initial frame into two superimposed horizontal volumes: a wide base topped by a slender longitudinal 9-storey volume; the 14-storey result was somewhat less dominant than the 25 initial levels proposed by Moussa and whose foundations were not adequately designed[40]. The continuity of these heavy volumes is lightened by the fine details of the parapets: long prefabricated lightweight concrete panels fixed to the floor of the terraces (Fig. 4-5).

This first project called for others, and Moretti's Italian collaborators, including Roberto Morisi (1926-2019) and Lucio Causa, continued to build in Algeria even after his death. For the project of the Ben Aknoun Law Faculty in Algiers (1975-1979) (Fig. 6-7-8), Roberto Morisi opted for a horizontal architecture that blends geometrically with the initial project but stands out by virtue of its monolithic and rough reinforced concrete to which are added a few bands of color, thus accentuating its *telluric* appearance. This effect of massiveness is distorted by a geometric sculptural treatment of the column that marks the entrance. It is boldly truncated in the middle, in an obvious challenge of the legible transfer of forces that the traditional relationship between the load and support calls for.

The cultural complex Riad El-Fath[41] (1982), designed in celebration of the 20th anniversary of the Algerian revolution, marks the transition towards a new monumentality of culture and leisure. Its sanctuary of the Martyrs (Maqam Ech'ahid) continues to be the most important monument of post-colonial Algeria. It is the product of a collaboration between the architect-sculptor Marian Konieczny (1930-2017), and the Algerian artist Bachir Yelles (1921), which was built by the Canadian company LAVALIN. A true technical *tour de force*, the 92-meter-high structure is composed of an eternal-flame altar covered by three gigantic concrete palms that merge at mid-height. This manipulation of symbolic and technical qualities give this project a techno-aesthetic value that oscillates between technical prowess and aesthetic symbolism. This monument superimposes the cultural and commercial *Arts Centre*. The center is built around an underground courtyard and flaunts a full structure of raw reinforced concrete that is accentuated by exposed brickwork. The visual image created by these two projects is a very powerful symbol of the country's new consumption-oriented political and economic orientations. (Fig.9)

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40 Jean-Jacques Deluz "La contribution de l'Agence du Plan," ["The *Agence du Plan* Contribution"] in *Alger*: *Paysage urbain et architectures: 1800-2000* [*Algiers: Urban Landscape and Architecture: 1800-2000*], ed. Jean-Louis Cohen, Youcef Kanoun, and Nabila Oulebsir (Besançon: Ed. de l'Imprimeur, 2003), 240.

41 For more about the full project see: Jean-Jacque Deluz, *L' urbanisme et l'architecture d'Alger: aperçu critique* [*Urbanism and Architecture in Algiers: A Critical Overview*] (Liège: Mardaga, 1988), 134. See also: Nassima Driss, "L'irruption de Makkam Ech-Chahid dans le paysage Algérois: monument et vulnérabilité des représentations" ["The Eruption of Makkam Ech-chahid in Algiers: The Monument and Vulnerability of Representation"], *L'Homme & la Société* 146-4 (2002): 61-76.

Culturalist, or crypto-technical paradigm[42]

To varying degrees, for the architects included in this paradigm, technique and/or the material take on a strong cultural connotation. Technicity is hidden behind cultural interfaces – ornament, historicist elements, analogical forms – that favor a rather figurative and aesthetic *overdetermination* of the architectural object. This paradigm takes on meaning in post-independence Algeria as an attempt of rehabilitating its architectural identity after many decades of colonial acculturation.

Right after the independence, Abderrahmane Bouchama (1910-1985),[43] with his strong moralist discourse, called for a revival of the Arabo-Islamic style. This new style would have to break with French architecture, and especially with the pastiche neo-Moorish constructions, the French produced. This Algerian post-revolutionary architecture would have to be scientific and socialist; its architects had a mission that goes beyond the functional and technical considerations. He wrote in 1966 that:

> "His [the architect's] task is not only to transcribe in stone, concrete or any other unusual material their [the people's] history, their needs, but also to sense their dreams, their inspirations, their future, and to snatch, symphonize, materialize and transform all this into tangible reality."[44]

The material, reinforced concrete or another, would thus be loaded with the moralist duty of materializing the intangible social imaginary. However, his own architecture[45] aroused much debate and controversy: the part played by technology, functionality, the genius of the people and even the specific character of its *Algerianness* is difficult to spot in his *decorative* minarets, classicist facades or in domes and arches that are modelled after those of the Alhambra and the Taj-Mahal. As for reinforced concrete, it would seem that although the material lends itself perfectly to this aesthetic of formal reproduction, its full technical and figurative potential is not properly revealed in Bouchama's work. The only exception to this, in our opinion, would be the Hydra mosque (1981), which, despite an eclectic appearance that combines Moorish, sub-Saharan and Berber references, bears the beginnings of a proper formal innovation. This building stands out considerably by the composition and plasticity of its twisted pentagon-shaped minaret, as well as by the prismatic forms of the roof that incorporate diamond-shaped glass openings to allow zenithal light in. (Fig. 10-11)

The tourist facilities program entrusted to the architect[46] Fernand Pouillon (1912-1986)[47] represents a complex manifestation of the culturalist paradigm. A good part of the abundant

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42 According to Simondon a crypto-technical object is an object whose technicality is hidden behind an intermediate interface or through additions without technical and functional utility and whose interest is purely cultural. See: Gilbert Simondon, "Psychosociologie de la technicité (1960-1961)" ["Psychosociology of Technicality"], in *Sur la technique (1953-1983)* [*On Technique (1953-1983)*] (Paris: Presses Universitaires de France, 2014), 37-39.

43 His design office was the most important in Algiers during the first years of post-independence. (See: Deluz, *L' urbanisme et l'architecture d'Alger*, 123.) He designed a significant number of mosques, administrations, and higher education premises, all in a neo-Moorish style. He also authored several books on architecture.

44 Abderrahemane Bouchama, *L'arceau qui chante* [*The Arch That Sings*] (Algiers: Éditions Nationales Algériennes, 1966), 56.

45 Deluz, *L' urbanisme et l'architecture d'Alger*, 128. For a different interpretation of Bouchama's architecture, see Sheila Crane, "Algerian Socialism and the Architecture of Autogestion," *Architectural Histories* 7-1 (2019).

46 Right from when he wrote his "Charter on Algerian Tourism" in 1966, the program of the tourist infrastructure was mostly assigned to F. Pouillon. To the great contempt of the architect Georgette Euziol-Cottin who had started it in 1964. For more on this controversy see: Assia Samaï-Bouadjadja, "Le fonds d'archives Georgette Cottin-Euziol: archive de toute une vie" ["The Georgette Cottin-Euziol Archives: An Archive of a Lifetime"], *ABE Journal* 16 (2019).

47 The work of F. Pouillon in Algeria takes a special place and is of a paradigmatic richness of its own and difficult to classify. Indeed, Pouillon even described himself as a *chameleon* in interview with Attilio

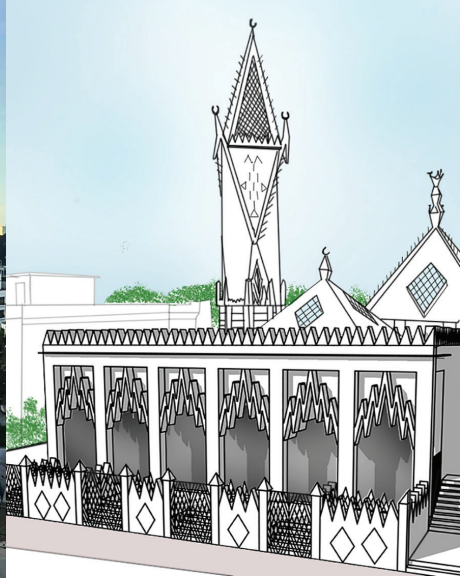

Fig.10 The minaret and rooftop of el Qods mosque. 2020
Fig.11 Perspective of el Qods mosque

projects he designed[48] in this context is marked by the choice of historicist references, which is both celebrated and criticized.[49] It shows an undeniable typological and compositional richness, but one that is sometimes almost camouflaged by the picturesque, borderline whimsical, quasi-eclectic aspect that envelops it: purist forms confronted with Ottoman, Andalusian, and even Roman references could be found in the same project. This manipulation of images and symbols that the architect engages in, even if it crosses the sphere of the trans-aesthetization of the architectural object dangerously and deliberately,[50] is a reflection of a temperate modernity, which is revealed through the freedom of his gestures and his technical inventiveness, even when the latter is hidden.[51] The different technical processes he developed and his deep mastery of a wide range of materials[52] – although he preferred stone – attest to his technical sensibility. However, it is curious that, despite his contempt for concrete's ageing, his postcolonial architecture in Algeria is built almost entirely with lime-coated reinforced concrete. While this twist is generally seen as a result of the economic and productive context, particularly the

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Petruccioli quoted in: Jean- Lucien Bonillo "Reconnaitre l'œuvre … et l'homme" ["Recognizing the Work … and the Man"], in *Fernand Pouillon architecte méditerranéen* [Fernand Pouillon A Mediterranean Architect], ed. Jean Lucien Bonillo et al. (Marseille: Imbernon, 2001), 25.

48 It reached a total of 57 projects. See: Amina Sellali and Rabeh Aït-Ali "Le retour à Alger" ["The Return to Algiers"], in *Fernand Pouillon architecte méditerranéen* [*Fernand Pouillon A Mediterranean Architect*], ed. Jean Lucien Bonillo et al. (Marseille: Imbernon, 2001), 97. These projects have been richly photographed by Leo Fabrizio. See his online gallery: https://www.leofabrizio.com/research/fernand-pouillon-et-lalgeriedocumented

49 For instance, André Ravéreau criticized this production and fought in vain against building the Matares Complex in Tipaza, fearing that the eventual project would contribute to the degradation of the Roman archaeological site or the trivialization of its charm. The eventual built project of Pouillon, with its arches and fortified castle, effectively disrupted the historical landscape of the site. See: André Ravéreau, *Du local à l'universel* [*From the Local to the Universal*] (Paris: Éditions du Linteau, 2007), 104. For a less scathing critique of this work see: Deluz, *L' urbanisme et l'architecture d'Alger*, 127.

50 On this matter J.J Deluz wrote: "...the artificiality of the relations which exist between Algerian history and the luxurious hotels intended for the international tourist fauna, gives an adulterated stamp to all this architecture, in which Pouillon plays, with an often dazzling mastery, the most heterogeneous references: Venice in Sidi Fredj, Aigues-Mortes in Tipasa...". See: Ibid., 127 (authors' translation).

51 In an interview with Marie-Hélène Contal, Fernand Pouillon declared that "molten into the architecture, the technique does not monologize." Quoted in: Bonillo, "Reconnaître l'œuvre," 16 (authors' translation).

52 F. Pouillon built in stone, metal, reinforced concrete and even in terracotta. See: Bonillo, Jean- Lucien. "L'expérimentation amoureuse des matériaux" ["The Materials-loving Experimentation"], in *Fernand Pouillon architecte méditerranéen* [*Fernand Pouillon, A Mediterranean Architect*], ed. Jean Lucien Bonillo et al. (Marseille: Imbernon, 2001), 124-137.

Fig. 12 The Dinosaur Museum of Naama. 2004

scarcity of stone in Algeria,[53] it seems to us that the development of a special stone powder concrete in one of its first building sites in Zéralda (Algiers) also contributed to this. This is an important techno-aesthetic quality of concrete, which is its capacity to induce technical innovation. As Adrian Forty explains,

> "Just as the original invention of reinforced concrete came from trial and error on the building site, even today it does not always need the resources of a scientific laboratory to come up with novel and original results. [….] But with concrete, though, there still remains the opportunity for the architect to be his or her own alchemist, and to create an entirely new substance. Primitive this may be, but in this quality lies part of concrete's appeal."[54]

The liberating potential of on-site experimentation that it offers to architects would partly justify its importance for them. As for Fernand Pouillon's case, this demonstrates that his deliberate crypto-technical positioning does not in any way reduce his profound technical inventiveness, but rather integrates it in a complex approach that amplifies the metaphysical dimension of architectural creation, and thus its aesthetics. It is therefore not impertinent to think that, however controversial his work may be, no other architect has been able to occupy such a special place in the Algerian history of construction and social imaginary as Fernand Pouillon.

Another nuance of this paradigm completely disregards historicist considerations. We can see it through the project of the Dinosaur Museum of Naama[55] (2004) (Fig. 12), designed by the French-Swiss architect Daniel Grataloup (1937). In this project, Grataloup uses his own technical process that couples sprayed concrete and a self-supporting metal mesh to obtain a monolithic and organic configuration. The resulting form recalls the silhouette of a *Chebsaurus algeriensis*[56] and turns the building into a habitable sculpture, which leads to a surpassing, however slight, of the primitive character of this technique.[57] This interpretation draws its aesthetic from both the *human-nature* phenomenological dialectic and the potential of the material (technical process) but which prioritizes the figurative nature of building over a display of its technicity.

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53 See: Sellali, Aït-Ali "Le retour à Alger," 95. However, the phanerotechnical – raw concrete – Plaza hotel he built in Annaba (Algerian east), is one example that demonstrates that this conversion to concrete goes beyond the issue of stone scarcity.

54 Forty, *Concrete and Culture*, 14, 39-40

55 The general work of Grataloup would fit more into the synthetic paradigm, but the analogical formal choices of this project conform more to the definition of Simondonian crypto-technicity. While this project doesn't exactly fit in the chosen timeline, its design philosophy and techno-aesthetics qualities connect it to the rest of our corpus.

56 An Algerian species of dinosaur also called Giant of the Ksour. This museum is built on the discovery site of its bones.

57 Andrea Deplazes argues that despite the potential of this concrete, it is reduced to its primitive nature by cave projects, i.e., housing projects whose shapes are reminiscent of natural caves. See: Andrea Deplazes, *Constructing Architecture: Materials, Processes, Structures* (Basel: Birkhäuser, 2005), 59.

The point of conjunction ... Synthetic paradigm[58]

Another approach explored during this period, as a continuation of the *Algerian Modernity* of the colonial period, was in favor of an interpretative approach that sought continuity between Algerian specificities and the situated values of Modernity. This matter of synthesis was interpreted variously by the different architects, but all paid particular attention to technique and details.

Jean Bossu (1912-1983) designed two projects of a particular plastic richness, the Domains office building: a small tower in Algiers and the prefecture of Tiaret. These two projects reveal his sensitivity to context: they monologize simultaneously with the city, the site and the usage. The prefecture of Tiaret (1969-1974) that was built on a hill overlooking the city is of particular originality. This tripod-shaped building, whose design reconciles different programmatic and functional considerations,[59] is carefully engraved on the terrain and elucidates its topography. It takes on a sculptural form through an elaborate play of raw and painted concrete – of a remarkable quality –, which has allowed the branches to be differentiated, through both the composition and treatment of the thick facades – a play of elements and colors –, and the sculptures adorning their extremities. This rather expressionist logic loaded reinforced concrete with a semiotic sense that is quite original, but which at the same time reminds us of Bossu's relationship with both Le Corbusier and the M'zab.[60]

The same sensitivity to the urban context also appears in Georgette Euziol-Cottin's projects (1926-2004).[61] Her work, however, is marked by a rational but temperate modernity that synthesizes the arts, the anthropological dimension and technique. Her various projects in Algeria - notably her Warnier church project (Chlef, 1958) and her proposal for a bridge-building that crosses a talweg in Bouzereah (Algiers, 1972) - attest to a great mastery of the reinforced concrete's morphology, which she exploits as a technical vector without glorification or fetishization.

On another hand, André Ravéreau (1919 – 2017), a fervent defender of vernacular architecture, is often evaluated through the prism of the culturalist paradigm, which presents his work as *passéist.*[62] This work, however, has proved that it is rather part of an interpretative study of the Tradition-Modernity relationship. For Ravéreau it is the detail itself, based on contextualized choices of the available material and appropriate process, that produces architecture. His unbuilt project of the thermal establishment Hammam Salhin[63] (1965-1966) in the city of Biskra in the Algerian south, is a perfect example of this. Its plastic reinforced concrete forms can be assimilated to both modern expressionism (Gaudi's Güell Park) and traditional forms (Algerian vernacular architecture of Touggert or that of Mozabit mausoleums), but they are most importantly functional. The roofs, thin reinforced concrete vaults in the shape of soup tureens, allow the evacuation of steam and the recuperation of condensed water, all the while ensuring ventilation. Ravéreau's aesthetics breaks with aestheticism and formalism: it is not the product of a search for form itself but of a search for formal legitimacy, that is to say, a form that can be justified by function, technique (including the material) and context.[64]

58 To the previous paradigms inspired by Simondonian notions, we introduce our own *synthetic* paradigm. The idea of synthesis is interpreted flexibly in the works of the various architects we consider in this section, but they all pay equitable attention to both the socio-cultural dimension and the technical one.

59 See: Xavier Dousson, *Jean Bossu: une trajectoire moderne singulière* [*A Singluar Modern Trajectory*] (Paris: Éditions du Patrimoine. Centre des Monuments Nationaux, 2014), 155-158.

60 Jean Bossu spent several years as a trainee in Le Corbusier's practice. In 1938, the latter sent him to the region of the M'zab (located in Algeria) to draw a series of sketches and surveys of the rich vernacular architecture of the city of Ghardaia.

61 Despite her importance as the only Algerian woman architect (before independence), Cottin's work is often overlooked by researchers. For more about her, see: Samaï-Bouadjadja, "Le fonds d'archives Georgette Cottin-Euziol."

62 Michel Ragon lables Ravéreau's architecture as "indigenism linked with modernity." Quoted in: Ravéreau, *Du local à l'universel*, 104.

63 For the portfolio of this project see: http://www.aladar-assoc.fr/portfolio/hammam-salahine/

64 On this subject he writes: "[...] I'm not going to say that I do not look for 'form', but this form, I only want it and I only like it as far as I can explain it to myself." Ravéreau, *Du local à l'universel*, 104 (authors' translation).

Fig.13, 14 View of the raised walkways (left) and amphitheater (right) of Tlemcen's House of Culture

The search for an interpretation of the Tradition-Modernity relationship also inspired the work of the Italian team of the BAUT[65] (Bureau d'Architecture et d'Urbanisme de Tlemcen,1969-1989), which designed a significant number of reinforced concrete buildings in Tlemcen (Western Algeria).[66] This return to tradition, however, was oriented towards its inherent logic of resource management and form rationalization. Among these various cultural, sports and leisure facilities, was the very first House of Culture of Algeria (1978). This project is defined by its pure geometrical forms and imbricated spaces, as well as by its rooftop amphitheater and the raised walkways that cross its courtyard. This typological richness, accentuated by the rational use of reinforced concrete, has enabled the complex to fit into its urban context all while maintaining an expressive and functional originality. (Fig. 13-14-15).

Conclusion

In this paper, we have attempted to explore the intersection of the techno-aesthetic questions raised by the architectural production of the second half of the 20th century in Algeria. The Algerian post-independence context presented an important opportunity for architectural and technical experimentation. The architectural reflections carried out in this context have all questioned the reinterpretation (or construction) of the Algerian identity and, in this elusive context, reinforced concrete was chosen as medium to transcribe these answers. On the basis of postures and latent techno-aesthetic choices, we were able to identify three major paradigms, which all reflect, despite the nuances and differences between them, an interesting spectral shift between aesthetics and technique: the *Phanerotechnical* paradigm: which magnifies an aesthetics of the technical gesture; the *Crypto-technical* paradigm: which favors a technique of the cultural aesthetics; and the *synthetic* paradigm: which is mediation between the two, in favor of a situated and plural expression. Moreover, we have seen that these techno-aesthetic choices allowed reinforced concrete not only to condense the cultural and social, but also to influence, via the process of cultural and technical transfer and the internationalization of the construction sector, the production process in the country and thus the movement of capital and industry. This architectural production, discredited and little-known, reveals the plurality of techno-aesthetic, and sometimes ethical, manifestations of reinforced concrete and reminds us that this elusiveness, even ambiguity, is inherent to it. Finally, it allows us to discern the paradigmatic richness that *the most discredited of materials can hide.*

The discussion on reinforced concrete in architecture can thus come down to discussions on the social, technical, ethical, aesthetic, historical and economic aspects. All of which make it a complex process whose legitimacy depends on the reconciliation of these, sometimes contradictory and inconsistent, measures. It is nevertheless unrealistic to want to continue

65 Founded in Tlemcen by Andrea Nonis and Vittorio Franchetti Pardo (1969-1974), with, later on, the collaboration of Claudio Screti (1971-1980) and Carlo Formichi (1977-1984).

66 Documented as part of the Elconum Project (Collaborative Development of a Digital Heritage Collection). See: http://elconum.huma-num.fr/

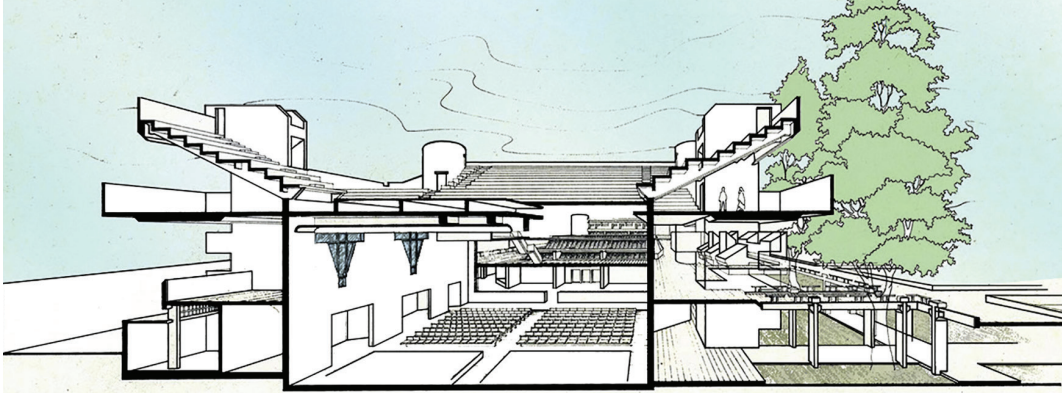

Fig.15 Perspective-section of Tlemcen's House of Culture

producing reinforced concrete architecture at the same pace and in the same traditions as those of the past century. The continuity of the use and evolution of concrete, as an important component of human history, depends on our engagement to better understand the machines, systems and technical artefacts among which we live.

Through the epistemological rehabilitation of these *paradigmatic histories of reinforced concrete*, this paper has tried to question some of the motivations and subtleties that could legitimize the much-criticized aesthetic quest in Architecture. We have seen that, due to both endogenous and exogenous influences, questions of aesthetics go much beyond a visual quest and, much like those of ethics, are inherent to the processes of architectural creation. This definitely requires the renewal of the methods that govern our perception of the double dialectic Architecture-Ethics/Architecture-Aesthetics and of the ethics that regulate our relationship to technical objects. Ultimately, any analysis of these questions should inevitably aim to reconcile their contradictions instead of alienating either of them.

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